

tains, on page 188, a description of twenty-two typical weather maps.

The object of the papers here presented, as stated by the writers, is to invite attention to the assistance a forecast official may derive from a file of weather maps, properly classified and indexed. As was to be expected, each of these writers has his own individual classification and his own method of indexing.

Professor Garriott emphasizes the fact that we must first decide what constitutes weather types. What shall guide us in classifying weather maps? Shall we say that because on two maps the distribution of barometric pressure is similar, these maps therefore belong to the same type? We agree with Professor Garriott that this does not necessarily follow. It is the *behavior* of the highs and lows that must be observed in making our classification, rather than their relative position at any given observation. How have they been built up, and what is their direction and rate of motion as compared with the normal for the month? Other meteorological elements, such as temperature and moisture, must also receive due consideration.

Professor Garriott has also pointed out that heretofore we have not received reports from a sufficiently extensive territory to enable us to classify weather types in the manner he indicates. As a rule, it requires but a few days for highs or lows to develop and pass off to the east of the United States, or even to cross the country from the Pacific to the Atlantic. If they fail to pass off within the usual time, we consider the conditions *abnormal*, and the persistency of highs and lows in maintaining a position just off the New England coast for several successive days has been a fruitful source of unverified forecasts.

Arrangements recently perfected by the Chief of the Weather Bureau whereby reports are cabled to the United States from Europe and the islands of the Atlantic enable us to study the movement of storms across the ocean, and it is believed will lead to more accurate forecasts for the United States; for it is evident that the movement of storms across our own country does not depend alone upon the atmospheric conditions here, but is also largely dependent upon the conditions to the east of us, and these have been particularly hard to determine in winter without direct observations because of the marked difference between continental and oceanic conditions during that season. As Professor Bigelow has pointed out,² conditions on the continent of North America in winter are particularly favorable to the development of storms.

There are periods when one storm follows another with almost clockwork regularity, only to be followed by a period of seeming stagnation, when apparently the cycle of eastward movements is blocked. It may well be that a knowledge of the conditions entirely around the Northern Hemisphere will be necessary to accurately foresee these periods of activity and of stagnation.

Forecasting based upon a knowledge of weather types without a knowledge of the forces that operate to produce these types, can not be considered strictly scientific. It is not reasoning from cause to effect, but rather an effort is made to correlate present conditions with conditions that existed at some past time and then it is assumed that like results will follow in each case.

With meteorology in its present state of development perhaps this is the best we can hope to do at present. As has been so aptly stated by the Chief of the Weather Bureau³ the science of meteorology "now awaits the genius of a Kepler or the magic of a Newton to unravel the mysteries that still baffle the student." It awaits a development of the mathematical laws of storms in such form that they can be applied to the every day problems of meteorology.

If we can learn to identify weather types, we have taken the first step toward a study of the forces that generate the types. The Editor therefore recommends to students of meteorology not only the classification and indexing of weather maps according to weather types, but also a critical study of the more important types, and of the apparently abnormal conditions that occasionally exist.

The forecaster must not, however, rely up a familiarity with types for his success in forecasting. No two storms will be found that are exactly similar in all respects. He must, therefore, learn to distinguish the causes that will result in producing certain types of weather or in modifying the current daily map.—H. H. K

THE INFLUENCE OF SMALL LAKES ON LOCAL CLIMATE.

In a letter to the Chief of Bureau the following questions have been asked:

1. Do the lakes in central and western New York have an appreciable influence on the amount of rain, snow, fog, or dew, and is this region consequently favored with a greater certainty of crops than neighboring localities?
2. Is the climate in their neighborhood modified in any particular so as to make it more desirable?

The following extracts are made from the Chief's reply:

There are a number of ways in which lakes affect the climate of their immediate neighborhood:

1. The reflection of the sun's light and heat from the surface of the water has a decided influence in warming the soil on the east, west, and north sides of the lake. If the banks are steep and high this influence is felt to a corresponding elevation above the water, but if they are very low it is inappreciable.

2. Evaporation from the lake surface throws more water into the air than evaporation from the ordinary fields or forests. There is, therefore, an increased tendency to the formation of fogs during the late night hours and calm weather, and a corresponding protection from frosts, up to the limit of the fog.

3. When the wind blows, the vapor being carried to the leeward side increases the chance of forming fog, cloud, and rain to a distance from the lake, depending upon the strength of the wind and the size of the lake. As the surface of the lake is cooler than the surface of the land in the summer time and in the middle of the day, the wind also tends to diminish the range of temperature on the leeward side of the lake.

The actual numerical amount of these lake influences must diminish with the size of the lake. Thus, on the east shore of Lake Michigan there is a region 5 miles broad, and at the southeast a region 10 miles broad, greatly protected by warmth, fog, and cloud when cold west or northwest winds are blowing. Without having any special local observations to guide our estimates we dare only suggest that the small lakes in central New York probably affect local climates very much as Lake Michigan does, but only to an extent proportional to their areas. That is to say, Lake Cayuga, for instance, having an area of 25 square miles, would have an influence of about one one-thousandth part of that of Lake Michigan, with its area of 25,000 square miles. Although local observers might be well persuaded that an occasional cloud or rain or fog is due to the presence of the lake, yet on the average of many years the influence of the lake would be inappreciable, at least so far as items 2 and 3 are concerned.

With regard to the first item, namely, the reflection of heat from the surface of the small lakes, we think that should be appreciable.

In so far as the small lakes occupy depressions into which the cold air may drain in still, clear nights, they do by that process oppose the formation of frost over the neighboring watershed, but this is an influence independent of the lake water, and depending only on the contour of the depression.

A comparatively thick network of observers with thermometers and rain gages would be necessary to convert these general expressions into figures.—C. A.

METEOROLOGICAL OBSERVATIONS WITH KITES AT SEA.¹

On page 419 of the MONTHLY REVIEW for September, 1901, we printed a short note outlining the work that Mr. A. Law-

² Report of the Chief of the Weather Bureau, 1898-99, Vol. II, p. 610.

³ National Geographic Magazine, 1897, Vol. VIII, p. 65.

¹ A. Lawrence Rotch, in Science, N. S., Vol. XIV, No. 362, p. 896, December 6, 1901.